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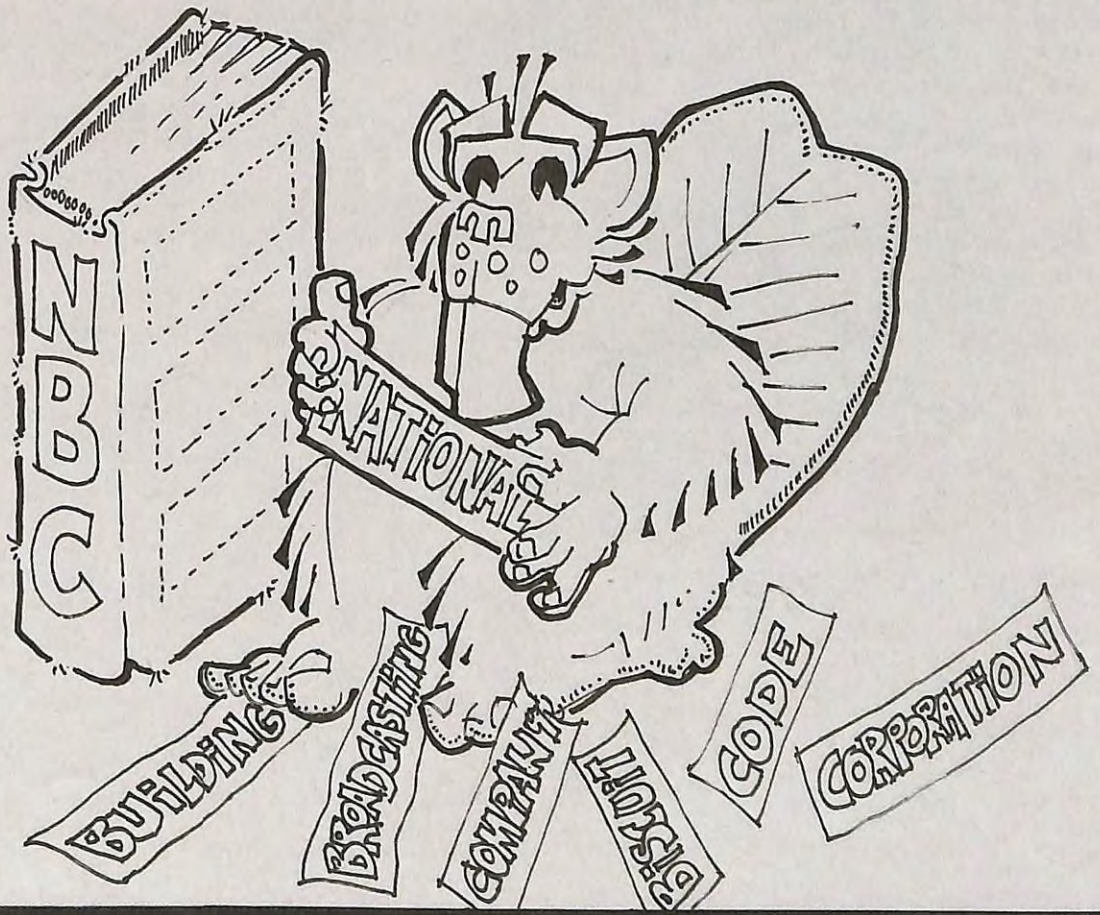


From the Editor . . .

Some days I wonder what sort of a world we've created.

We recently encountered an experience familiar to many – the mindless call-centre maze. It all started when we decided to add a TV set to the cable service that we receive from the phone company that has been serving us well with phone and Internet service for years. As is common today in the digital environment, the cable provider has their black boxes that need to be programmed so that signals can be decoded to the TV sets.

Taking advantage of a sale, we purchased our own digital box from a local dealer. That's when the fun began. It was easy to hook up the unit, until the window requiring the magic access code came up. So we called the service provider only to be told they need to send out a technician to hook it up. No matter that we know how to do it, no matter that their technician set up the service not too long ago and explained everything, no matter that the whole house is wired through a central panel, so there is no wiring involved.

We were told their technician had to come out and set it up – nothing could be done about it, strict company policy. It came up that since the box was bought from an authorized dealer, the service call was included in the purchase price and they could book the technician for us right then.

That was the start of the fun. Although they had our account number, street address and all other pertinent information, they couldn't make the booking because they couldn't find the address to give to the technicians. Something was wonky on the database.

"Are you sure you've got the right address? What was the number again?" Account number, name and address were spelled out letter by letter. After a considerable amount of time, and discussion with another supervisor who restated that company policy does not allow them to hand out the code, it's got to be a technician to go to the house, etc. etc, they still weren't able to book the appointment, even though they could tell the status of service from their end.

Turns out that the call centre is in Nevada, which sort of explains why they had no inkling of the Vancouver geography and couldn't find the address, and had to rely on what they saw on their screen. Never mind the years of service they've been providing through landlines and managing to send invoices that got paid.

After a couple of hours, an apology for the delay, a credit on the next invoice for the time, the supervisor came back and gave us a secret code. The problem was it was a code they had already assigned to the first TV their technician hooked up.

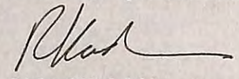
Next day, back on the phone, same story. Once again, the company policy is they can't give out a code by phone, it's got to be our technician on site. After another couple of hours, and another "customer care" supervisor, they somehow found a way to give us another code to make everything work the way it should, without having to send out the technician.

The cost in our aggravation and time lost, to say nothing of the cost to the company must add up, however, they ended up saving by not having a technician spend an hour or more coming to the site when it wasn't needed.

The call centre scenario might seem efficient, but it would be cheaper, and less frustrating for all concerned to look at the problem and deal with it directly, rather than following a script.

I wonder how in the world did we get to the point we're at today. Technology is wonderful, but it's not the answer in itself, even though we're sometimes lulled into thinking it is. It still takes someone to apply some common sense.

This is a scenario that replays itself in many ways, in all industries. There are many instances that in our business we follow similar crazy practices and rule-books rather than empowering our employees to apply common sense and their knowledge and expertise to do the right thing at the right time in the most expeditious manner.



Richard Kadulski,
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National Building Code: Proposed Energy Requirements

The National Building Code of Canada has introduced energy efficiency as another objective for the code. For larger commercial and institutional buildings that fall under Part 3 of the code, the energy requirements are found in the National Energy Code of Canada for Buildings (NECB), which was issued in late 2011 and is an update of the MNECB first published in 1997.

For the residential sector and all other smaller buildings covered under Part 9 of the code, it was decided not to update the original Model National Energy Code for Houses (MNECH). Instead, it was decided to draft new regulations and incorporate them directly within Part 9 of the National Building Code.

The new energy regulations will appear as Section 9.36 of the NBC. Although the new requirements are built on the 1997 MNECH, they have been prepared keeping in mind current construction practices and standards that already exist across the country. The requirements are applicable to all Part 9 buildings, but for larger non-residential and mixed-use buildings that come under Part 9 the energy efficiency requirements will have to be met by compliance with the NECB.

Energy Target

The provinces and territories requested that the energy efficiency targets for Part 9 housing be prescriptive in nature, and that houses built in accordance with the requirements should be comparable to that of houses with an EnerGuide rating (ERS) of 80. Although the target is not enshrined in the proposed code, it was used as a working goal.

The proposed requirements do not quite reach ERS 80 but they still produce significant energy reductions compared with current construction practices. It was agreed by the Codes Centre Executive that the proposed requirements would still achieve significant progress towards energy efficient construction while staying within the bounds of industry knowledge, available construction practice, cost, enforcement and constructability issues.

The code now will be setting the minimum energy performance standard that all buildings must comply with, so while some may want to see more aggressive criteria, the current proposals are considered to offer a reasonable, realistic minimum standard for Canadian housing. The code does not prevent builders moving beyond, which is why building programs like R-2000, Energy Star, LEED and others are updating their energy standards to take their performance criteria much further.

The country has been broken up into six climate zones in 1000-degree day (°C) steps. This is identical to those used in the 2011 NECB and ASHRAE E90.1. Proposed requirements are provided by climate zone.

Validation of Energy Performance

Proposed code requirements were tested using eleven archetype houses in each of the six climate zones. The archetypes were based on those developed by NRCan to validate builder option packages for NRCan's Energy Star for New Homes Initiative. The archetypes were slightly modified for this project to better reflect current construction practice across Canada, as identified by independent reports prepared for the NRC.

The eleven archetype houses include 2 one- and 9 two-storey houses, 9 detached and 2 row-houses in varying sizes from 92 m^2 (1000 ft^2) to 325 m^2 (3500 ft^2) with an average floor space of 195 m^2 (2100 ft^2). Some of the archetype houses feature cathedral ceilings, slab-on grade construction, full basements and crawl spaces.

The results of the validation were used to optimize requirements and achieve consistent energy

The proposed code requirements cover the building envelope; heating, ventilating and air conditioning equipment; service water heating and performance compliance options for housing. The draft proposals are available for public review and comment on the Canadian Codes Centre web site until 4:00 p.m. EST on March 2, 2012.

If approved by the Canadian Commission for Building and Fire Codes (CCBFC), the energy efficiency requirements for housing and small buildings will be published as revisions to the 2010 NBC near the end of 2012.

Information
http://www.nationalcodes.ca/eng/public_review/2012_1/proposed_changes.shtml

performance results for houses across the climate zones and across different house configurations.

No Differentiation for Construction Assemblies

The energy efficiency requirements for NBC Part 9 buildings address the energy used by the building with no exemption being granted for any specific type of construction assembly. This levels the playing field for energy use by the building regardless of the type of construction used.

No Differentiation on Energy Sources

The energy efficiency requirements address the energy used by the building irrespective of the energy source. This removes the impact of variation in energy source characteristics and relative cost from one region to another.

Renewable Energy

It was recognized that alternate energy sources enable innovation in the energy-efficient design of houses and buildings, and that there should be no Code barrier to their use. However, renewable energies are not being addressed at this time due to the current difficulties with defining terms such as alternate or renewable energy that might be acceptable to all jurisdictions. The proposed requirements for Part 9 buildings remain silent on this topic. Alternative solution proposals from proponents that rely on alternate/renewable energy sources are the way they would be introduced.

Compliance Paths

The proposed energy efficiency requirements offer a prescriptive compliance path, including a simple trade-off option for the building envelope, and a performance compliance path.

Prescriptive Compliance Path

The proposed prescriptive requirements address the building envelope, heating, ventilating and air conditioning equipment, and service water heating for houses, larger residential and small non-residential Part 9 buildings. Prescriptive lighting and electrical power requirements are not addressed. Prescriptive requirements for building envelope components are summarized in our table.

The prescriptive requirements for the building envelope elements also allow three simple trade-offs. These have been introduced to allow some flexibility in the construction and design of energy efficient features in the building envelope. This allows builders and designers to reduce the effective thermal resistance of one or more assemblies below the minimum required, as long as the equivalent of the total area and required effective thermal resistance for that assembly is provided elsewhere. The simple trade-off method only applies to above-ground assemblies and has strict limitations.

Trade-off Option 1 - Opaque Areas

This trade-off option allows the reduction of the R-value of one building envelope area by increasing the R-value of another to achieve the same energy loss through the combined total area. The sum of the areas of each of the traded (reduced and increased) components must remain the same. There are limits on how much a thermal resistance value can be reduced.

Trade-off Option 2 - Window Performance

This trade-off option applies where a designer wants to increase the U-value of one or more windows but reduce the U-value of others to achieve the same energy loss through the combined total area of all windows. The sum of the areas of all traded (reduced and increased) components must remain the same. This option is limited to windows in the same orientation, and is meant to permit the use of a specialty decorative window unit (e.g. a small heritage feature window).

Trade-off Option 3 - Trading Window Area for Reduced Attic Insulation

A simple trade-off option is provided for buildings with low floor-to-ceiling heights and small window to wall ratios. It recognizes the proven energy performance of single-section factory-built buildings that are subject to transportation height limitations. The trade-off is provided to avoid unnecessarily imposing performance modelling costs. It is unlikely to be applied to site-built buildings, or to factory-constructed buildings that are not subject to stringent transportation height restrictions.

This option is limited to houses with a window-to-wall ratio of less than 15%. These units use less energy due to fewer windows compared with the reference wall to window ratio of 17%. This energy "credit" is then traded against a reduction in the RSI-value in the attic where, due to extremely low roof slope, it is impossible to install the required insulation level.

A trade-off between building envelope and high efficiency mechanical equipment is not included, but the use of a heat recovery ventilator (HRV) is given credit in the building envelope section with a reduction in overall effective R-values for some assemblies.

Performance Compliance Path

In the performance path, compliance is demonstrated when the calculated annual energy consumption for a proposed house does not exceed the energy target for a reference house, assumed to be built to prescriptive requirements in the same climate zone and orientation as the proposed house. The calculated annual energy consumption of the proposed house must then not exceed that calculated for the reference house.

The compliance calculation method uses a number of assumptions regarding operating conditions to standardize the calculation and exclude occupant behaviour and other issues not dealt with in the code requirements.

Airtightness for the reference house assumes 2.5 air changes per hour at 50 Pa, which is a reasonable assumption after the proposed prescriptive requirements on airtightness have been complied with. For the proposed house, three options are offered on how to calculate airtightness:

- 3.2 air changes per hour (where the designer assumes compliance with Section 9.25. only)
- 2.5 air changes per hour (where the designer assumes compliance with proposed prescriptive energy efficiency requirements, which include a number of airtightness measures), or
- as measured, in air changes per hour (where the model assumes a "design airtightness" for the calculation and the designer verifies the airtightness using a blower door test once the house is constructed).

Although the code will not require any specific software be used, the structure of the requirements will make it easy to use HOT2000, which is the most commonly used simulation tool for energy performance of houses in Canada. HOT2000, developed and supported by NRCan, is used in the delivery of NRCan's housing programs, and there is a large network of energy advisors across Canada with expertise in its use. It is expected that a code compliance version of HOT2000 will be made available so that energy advisors will be able to do performance path calculations quickly.

Technical Requirements

Prescriptive Path – Building Envelope

The proposed requirements for building envelope components (walls, ceilings and floors) are stated in effective thermal resistance values. This means that the requirements take into account heat flows through all parts of an assembly – not just the heat flow through the insulation but also the thermal bridging through framing. This differs from current practice in most regulations that spell out nominal insulation values only.

Information on how to calculate the effective R-value (RSI), as well as thermal properties of common building materials, is provided in the appendix. A few simple look-up tables for common construction assemblies are also provided.

Heat Loss Through Walls, Ceilings and Floors – Above Ground and Below Ground

Heat loss through walls, ceilings (roofs) and floors is one of the most significant factors for the energy performance of housing and small buildings. Proposed prescriptive requirements are provided for each assembly type. The effective thermal resistance values take into account common insulation types and construction techniques. An overlying requirement calls for insulation continuity, with a few exceptions for small structural penetration areas as well as for a reduction in insulation values (for example, in the sloped portion at the perimeter of an attic-type ceiling or in the above-ground portion of a foundation wall).

The required R-values are presented in two separate tables – one where an HRV is installed, the other where it isn't. This approach recognizes

R-values and U-values

Requirements for windows and doors are expressed in maximum thermal transmittance (U or USI) or maximum energy rating. Requirements for skylights are expressed only in U-values. U-values are referred to with the acronym "U" and are measured in W/m2•°C.

The phrase "R-value", or the simple prefix "R", should be understood to mean the imperial equivalent of the RSI. The imperial R is measured in h•ft2•°F/btu and can be converted into the metric RSI by dividing it by 5.678 (RSI=R/5.678). Where R is used in the proposed requirements, it is for information purposes only. The legally binding requirement is, in all cases, the metric RSI value.

Our table lists the proposed minimum effective R-values - numbers in brackets are nominal imperial values.

Minimum Effective R-value of opaque assemblies – No HRV RSI *(R-value)*						
	Heating Degree days (°C)					
	<3,000	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000+
Ceiling below attic	6.9 *(40)*	8.66 *(50)*	8.66 *(50)*	10.43 *(60)*	10.43 *(60)*	10.43 *(60)*
Cathedral & vaulted ceiling	4.75 *(31)*	4.75 *(31)*	4.75 *(31)*	5.07 *(34)*	5.07 *(34)*	5.07 *(34)*
Walls	2.93 *(20)*	3.27 *(24)*	3.27 *(24)*	3.27 *(24)*	4.13 *(27)*	4.13 *(27)*
Exposed floors	4.75 *(31)*	4.75 *(31)*	4.75 *(31)*	5.07 *(34)*	5.07 *(34)*	5.07 *(34)*
Rim joists	3.16 *(20)*	3.46 *(22)*	3.46 *(22)*	3.46 *(22)*	3.67 *(24)*	3.67 *(24)*
Values in brackets are approximate nominal Imperial insulation levels required to achieve min. required effective R-value						

Minimum Effective R-value of opaque assemblies – where HRV is installed RSI *(R-value)*						
	Heating Degree days (°C)					
	<3,000	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000+
Ceiling below attic	6.9 *(40)*	6.9 *(40)*	8.66 *(50)*	8.66 *(50)*	10.43 *(60)*	10.43 *(60)*
Cathedral & vaulted ceiling	4.75 *(31)*	4.75 *(31)*	4.75 *(31)*	5.07 *(34)*	5.07 *(34)*	5.07 *(34))*
Walls	2.93 *(20)*	3.16 *(22)*	3.16 *(22)*	3.16 *(22)*	3.27 *(24)*	3.27 *(24)*
Exposed floors	4.75 *(31)*	4.75 *(31)*	4.75 *(31)*	5.07 *(34)*	5.07 *(34)*	5.07 *(34)*
Rim joists	3.16 *(20)*	3.32 *(20)*	3.32 *(22)*	3.32 *(22)*	3.46 *(22)*	3.46 *(22)*
Values in brackets are approximate nominal Imperial insulation levels required to achieve min. required effective R-value						

Windows and Doors						
Maximum U value (USI)						
Doors & windows	1.8	1.8	1.6	1.6	1.4	1.4
skylights	2.9	2.9	2.7	2.7	2.4	2.4
	U-values of 1.8 or better typically are argon filled glazing units with a low-e coating and insulating spacer materials. U-values of 1.6 typically are triple glazed; U-values of 1.4 typically are triple glazed with multiple low-e coatings.					
Minimum Energy Rating (ER)						
Doors & windows	21	21	25	25	29	29
	ER rating is a measure of its overall performance, taking into account solar heat gains, heat loss through frames, spacers and glass and air leakage. The value has no units but can be used to rank window energy performance.					

Foundation insulation – No HRV						
	Heating Degree days (°C)					
	<3,000	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000+
Foundation walls	2.05 *(14)*	3.17 *(20)*	3.17 *(20)*	3.57 *(24)*	3.57 *(24)*	4.17 *(27)*
Unheated basement floor						
- below frost line	Uninsul	Uninsul	Uninsul	Uninsul	Uninsul	Uninsul
- above frost line	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*
Heated basement floor	2.32 *(12.5)*	2.32 *(12.5)*	2.32 *(12.5)*	2.85 *(15)*	2.85 *(15)*	2.85 *(15)*
Foundation insulation – with HRV installed						
Foundation walls	2.05 *(14)*	3.17 *(20)*	3.17 *(20)*	3.17 *(20)*	3.17 *(20)*	3.17 *(20)*
Unheated basement floor						
- below frost line	Uninsul	uninsul	uninsul	Uninsul	uninsul	uninsul
- above frost line	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*
Heated basement floor	1.96 *(10)*	1.96 *(10)*	1.96 *(10)*	2.85 *(15)*	2.85 *(15)*	2.85 *(15)*
Values in brackets are approximate nominal Imperial insulation levels required to achieve min. required effective R-value						

that heat recovery ventilation offers a significant energy benefit and that some provincial codes make the use of HRVs mandatory. However, the use of HRVs in the proposed requirements is not mandatory.

Windows, Doors and Skylights

The compliance for windows, doors and skylights can be demonstrated using maximum U-values or, for windows or doors, the minimum Energy Rating (ER). It is recognized that the maximum required U-values and ER ratings for windows and doors do not necessarily provide the same energy performance. Both are, however, considered acceptable metrics for the energy performance of windows and doors and either of the two values is readily available within the industry. Skylights are not measured in ER ratings and must therefore comply with maximum U-values.

Fenestration and Door to Wall Ratio (FDWR)

Unlike in the NECB, a maximum window area is not proposed in the prescriptive path because it was determined that current construction practice across Canada is that houses on average have a 17% window to wall ratio. It was considered that adding a requirement to calculate window/wall ratios was adding undue requirements that weren't meaningful.

However, in the performance compliance path, a maximum window to wall ratio is set for the reference house. If the FDWR of the proposed house is less than 17%, the FDWR for the reference house can be assumed to be 17% and this will provide an energy credit. If the FDWR for the proposed house is between 17% and 22%, the reference house's FDWR must be the same as that for the proposed house. Where the proposed house has a FDWR greater than 22%, the FDWR for the reference house must stay at 22%, creating an energy penalty for the proposed house. The FDWR of the proposed house is always calculated based on the house's actual design.

Air Leakage

Air leakage has a big impact on the energy performance of housing and small buildings and is a major source of heat loss. The proposed requirements include specific details that must be air sealed and which should limit uncontrolled air leakage. These requirements apply to the minimum requirements that already are addressed in Section 9.25.

Technical Requirements: Heating, Ventilating, Air-Conditioning (HVAC) Equipment Efficiency

The energy efficiency of HVAC equipment is a very significant contributor to the energy performance of houses and buildings, so proposed changes address minimum requirements for equipment and also list the product standards for each equipment type.

Ducts, Vents and Controls

In general, the requirements for energy efficiency of heating, ventilating and cooling equipment follow the scope and application of Sections 9.32 and 9.33, which means that design (sizing) and construction of HVAC equipment and systems is generally assumed to serve dwelling units. The energy efficiency requirements address air intake and outlets, where pipe and duct insulation is required, as well as location of equipment and temperature controls. A reference to the NECB is provided where equipment or techniques are employed that are not listed in the proposed Subsection.

Heat Recovery

Since the building envelope requirements for above and below ground depend on whether an HRV is installed or not, the minimum performance for HRVs is addressed. A minimum performance requirement for heat recovery ventilation is set, depending on the climate at the building location. The testing parameters are typical in the HRV market, and there are a number of HRVs that would meet these requirements.

Renewable Energy

The proposed requirements for HVAC equipment efficiencies remain silent on the use of renewable energy sources but address heat pumps and solar space heating equipment as acceptable solutions. However, no energy credit or trade-off is provided for their use. This approach avoids placing barriers on renewable/alternative energy source usage, and allows jurisdictions to consider their use via the alternative solution compliance path.

The requirements for solar thermal technology reference manufacturer's instructions, CSA F379 and the National Plumbing Code for equipment installation and energy performance.

Technical Requirements: Service Water Heating

The energy efficiency of water heating equipment also contributes to the energy performance of housing and small buildings. The proposed changes identify minimum performance requirements for a number of equipment types and energy sources. They also list the product standards for each equipment type and sometimes differentiate the performance requirements depending on equipment size. Storage-type water heaters, as well as tankless heaters, are addressed.

The proposal for water heating equipment efficiency follows the scope and application of Section 9.31 and ultimately the National Plumbing Code as it applies to dwelling units. The proposed energy efficiency requirements set out where pipe insulation and temperature control of water heating equipment is required and also address recirculation lines. A reference to the NECB is provided for where equipment or techniques are employed that are not listed in the proposed Subsection.

Renewable Energy

The requirements for water heating equipment efficiencies remain silent on the use of renewable energy sources but address heat pumps and water heating equipment as acceptable solutions. However, no explicit credit or trade-off is provided for their use. This approach avoids placing barriers on renewable/alternative energy source usage and allows jurisdictions to consider their use in proponent proposals via the alternative solution compliance path.

The proposed requirements for solar thermal technology reference manufacturer's instructions and CSA F379 via the National Plumbing Code for equipment installation and energy performance.

Application of the Proposed Requirements

The performance path only applies to houses, houses with a secondary suite, and buildings that contain only dwelling units and common spaces occupying more than 20% of the building's entire floor areas. It cannot be applied to non-residential occupancies and buildings.

The maximum limit for common spaces is 20% of the total floor area, because larger, purely residential Part 9 buildings are known to use about 15% for hallways, staircases and vestibules, and some other common spaces. The 20% limit was chosen to allow for some flexibility as well as because the percentage of common space floor area per building area often increases with small to medium multi-unit residential buildings. A proposed definition further clarifies that unheated garages, crawl spaces, vertical service shafts, and elevator shafts are not considered common spaces.☼

Ontario Energy Efficiency Regulations

Information:
Ontario Ministry of Housing
Ontario Ministry of Municipal Affairs and Housing
http://www.mah.gov.on.ca

As of January 1, 2012, houses and other small residential buildings (i.e. Part 9 residential buildings) must comply with the new energy efficiency requirements set out in the Ontario Building Code (OBC).

Under these new requirements, the energy efficiency of houses and other small residential buildings that are intended for occupancy on a continuing basis during the winter months must have a performance level that is equal or better than EnerGuide 80 (ERS) when evaluated in accordance with the EnerGuide Rating System or conform to Supplementary Standard SB-12, which is referenced in the OBC.

In Ontario, the EnerGuide 80 requirements are calculated with HOT2000 Version 9.34c – this is an older version of the software no longer supported by NRCan. In the remainder of Canada, Version 10.51 is current. The difference is that the new version has adjusted calculations and assumes higher efficiency combustion appliances. The result is that an ERS 80 calculated with Version 9.34 translates roughly to an ERS 78 when calculated in the current version of HOT2000.

The prescriptive alternatives in the OBC also include compliance with the Energy Star technical requirements for Ontario (January 2011 version).

More recently, on Dec. 5, 2011, SB-12 was amended to provide additional alternative compliance paths that permit slightly lower levels of wall insulation as long as those levels are compensated for with other energy efficient building elements. The amendment also includes Air Barrier requirements that are more descriptive. These requirements have been moved back to Part 9 (9.25.3) of the Building Code.☼

Canadian Home Builders' Association

Technical Research Committee News

Built Green® Changes

As we've reported previously, the Built Green® Canada program has made a significant change in their technical requirements. The minimum performance requirements have been integrated into the Built Green® Checklist, and now there is no longer a minimum EnerGuide score required for Built Green® Certification.

Although there is no longer a minimum performance that must be met, any home seeking Built Green® Certification must still be modelled and rated.

In the past, Built Green required a minimum EnerGuide rating (ERS) be met. In place of the minimum performance levels, there are three pre-set builder option checklists with pre-defined checklist options, and the minimum point requirement for the Envelope and Energy category increases to 30 points for Silver, 35 for Gold, and 40 for Platinum.

As an alternative to using the checklist for the Envelope and Energy section, a builder may opt to follow a performance path by modelling the home performance. Points are scored according to the ERS score at 5 points for each EnerGuide number above 75. For example, ERS 80 earns 25 points and meets the minimum requirement for this category and Bronze, ERS 82 would earn 35 points for Gold level, ERS 83 would earn 40 points for Platinum level. By selecting the ERS performance, no checklist points are earned in this category.

It will be interesting to see whether the checklist by itself will achieve the higher performance desired or higher volumes of certifications. Based on experience in Vancouver, and other areas, prescriptive requirements on their own do not always yield the desired results unless there is a rigorous compliance requirement.

Fire-Resistant Coatings on Exterior Sheathing

In 2009, the Alberta Building Code was amended to address fire safety in new buildings. The code requires that where combustible siding is to be used, and the limiting distance is less than 1.2 metres (3.9 ft.) (or 2.4 metres where the fire department response time is more than 10 minutes), the combustible siding must be installed over gypsum sheathing or masonry.

Since then, a number of fire-resistant coating products have come into the marketplace and are being marketed as an alternative to gypsum sheathing, although when a wood-based sheathing product treated with a fire-resistant coating is proposed, an alternative solution application must be submitted to the authority having jurisdiction for consideration as a code variance.

On February 2 Alberta Municipal Affairs issued a memo that effectively limits the use of treated wood sheathing. The memo recommens that local authorities only consider fire-resistant treated wood-based sheathing materials as alternative solutions to gypsum sheathing where it can be shown the proposed alternative adequately addresses:

Fire resistance: the product must have equivalent fire performance characteristics of 12.7 mm gypsum sheathing (15 minutes resistance as tested according to CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials").

Flame spread: the product must have the equivalent flame spread performance characteristics of 12.7 mm gypsum sheathing (a flame spread rating of less than 25 as tested according to CAN/ULC-S102, "Test for Surface Burning Characteristics of Building Materials and Assemblies").

Water & UV Resistance: the product must be capable of withstanding expected water and ultraviolet exposures and maintain fire and flame spread performance characteristics over repeated exposures.

Freeze/Thaw Resistance: the product must be able to withstand expected temperature variations and maintain fire and flame spread performance characteristics over repeated exposures.

Water Vapour Transmission: the product as installed should have no detrimental effects to the building envelope's ability to shed moisture.

Quality Control: the manufacturer must be able to demonstrate that the product is manufactured and applied to the wood-based substrate in a consistent and verifiable method.☼

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.
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Comparing Green Building Programs

Green building requires that best practices be followed. This means taking into account a building's orientation, building a tight envelope with good insulation levels, providing appropriate ventilation and using materials that have a low impact on the environment and create a healthy home.

A number of labelling systems have been developed to promote a commitment to building green. Some labels focus only on energy efficiency, others are more related to material choice and broader environmental impact. So how does one choose? To help you assess different labels, Doug Overholt with BC Hydro's Power Smart New Homes program developed this table to summarize their points in the major programs in a table below.

	ERS (EnerGuide Rating Service)	Energy Star for New Homes	R-2000	LEED® Canada for Homes	Built-Green®	Passive House	Power Smart New Home Program
	Natural Resources Canada (NRCan)	Natural Resources Canada (NRCan)	Natural Resources Canada (NRCan)	Canada Green Building Council	Built-Green Canada	Canadian Passive House Institute	BC Hydro
Program Focus	Energy Efficiency	Energy Efficiency	Energy Efficiency & Environmental Building Practices	Environmental Building Practices & Energy Efficiency	Environmental Building Practices & Energy Efficiency	Energy Efficiency	Energy Efficiency
Performance based Program	YES	YES	YES	YES	NO	YES	YES
Prescriptive Features Checklist	NO	YES	YES	YES	YES	YES	NO
Green Building Features REQUIRED	NO	NO	YES	YES	YES	NO	NO
EnerGuide Rating REQUIRED	YES	YES	YES	YES	YES/NO*1	NO	YES
Minimum Energy Performance REQUIRED	NO	YES ≥ERS80	YES ≥ERS86*4	YES ≥ERS76	NO*2	YES ≤ 15KWh/m^2/yr (Heat) & Primary Energy 120kWh/m^2/yr	YES ≥ERS80
Air Leakage Performance REQUIRED	NO	YES ≤ 2.5 ACH_{50}	YES ≤ 1.5 ACH_{50}	YES ≤ 3.5 ACH_{50} (Zone A)	NO	YES ≤ 0.6 ACH_{50}	NO
Balanced Ventilation with Heat Recovery REQUIRED	NO	YES	YES	NO	NO	YES	NO
Mid-construction blower door test REQUIRED	NO	YES	YES	NO	YES	YES	NO
Typical File Admin & certification costs	$400-700	$400-700	~$1,100	~$2,500	$400-700	~$2,500	$0*3
Notes	*1 ERS label is REQUIRED, but achieving a specific level is only required for the performance option.						
	*2 A specific ERS level is only required for the performance option only.						
	*3 No program admin fees, but determining the ERS does involve certification fees.						
	*4 Proposed new R-2000 energy target is 50% better than new energy code requirements; building envelope itself has a target that is 25% better than code minimum before mechanical upgrades are considered.						

Labels that require a verifiable performance have the best integrity. But ultimately, to gain value from the label, the builder must translate it into something relevant to the buyer. Here's our thoughts:

EnerGuide: useful because it gives a buyer something to compare, from home to home (both existing homes and new homes).

Energy Star for New Homes: prescriptive program offering 25-30% better performance than code or standard building practices; not available in all regions at this time.

R-2000: probably the highest performance standard, with an absolute pass or fail criteria; 50 percent more energy efficient than current construction practices (and coming energy code upgrades).

LEED: administratively cumbersome; strong focus on materials but energy efficiency requirements are downplayed.

BuiltGreen: probably the easiest way to get into a green building program; tiered structure allows builders to test the waters and decide how far they want to go. Unfortunately, it has been watered down by recent removal of minimum performance requirement.

Passive House: European standard approximately equivalent to a current EnerGuide rating of 86-88 (and the newly revised R-2000 standard). Administratively intensive.

Power Smart New Home: a label that demonstrates a home has achieved a certain EnerGuide rating. Used by BC Hydro (and some other utilities) in their incentive programs.

Durable, Energy Efficient Walls

Exterior walls have to keep the outside out and the inside in. The wall assembly has to control rain, air, vapour and heat. This means that walls need four layers of control:

- rain
- air movement
- vapour movement
- heat movement

The best place for the control layers is to locate them outside of the structure in order to protect the structure – especially steel and wood structures. Protecting the structure reduces the environmental effects of expansion, contraction, corrosion, decay, ultraviolet radiation, and most other things that are functions of temperature.

So where to put the insulation? If we put the insulation within the structure, as is the norm in frame construction, the insulation does not protect the structure from heat and cold. To improve on this, we need to look at details that some builders are already using – placing at least a portion of the insulation on the outside of the structure.

Rain control is reasonably well understood. Exterior cladding serves as the first layer of protection to keep rain and snow on the outside, while the drainage plane serves as the second layer of protection, stopping any water that does penetrate the cladding from moving further into the wall assembly. Exterior cladding construction details are well understood, although with exterior insulation, some detailing of both the cladding and the drainage plane may need to be reconsidered.

Air movement can carry a lot of water in the form of water vapour, so it is important to prevent air movement across the structure because it can carry water as well as cold air that will allow condensation within the assembly. This is where air barriers that restrict airflow become important. The best place to control air movement is on the outside of the structure but protected by insulation so that the air barrier is protected from extremes of temperature.

At the same time, as we air seal the building, we need to control the indoor environment for the occupants. This means that we need to properly design the systems in the house that will not only provide heating and possibly cooling, but also control the indoor air quality.

Thus the perfect wall will have a water control layer on the outside, air control layer and vapour control layer directly on the structure and a thermal control layer over the top of the other control layers.

Much misunderstood is the vapour movement control layer. The building code calls it a *vapour barrier* but it really is a vapour diffusion barrier.

There is always some moisture in the air, and that moisture can move by a diffusion process.

Diffusion occurs if one area has a higher moisture level than another one, such as the movement of moisture from the bathroom to the bedroom after a hot shower has filled the bathroom with steam. Another example of diffusion is the movement of moisture through a floor above a damp crawl space and into the house above.

Diffusion happens even if there is no air movement at all. Just as heat moves from a warm space to a cold space, water vapour will travel from a space with a high moisture concentration to a space with a lower moisture concentration, even if it has to go through a wall. Cold air almost always contains less water than hot air, so diffusion usually carries moisture from a warm place to a cold place.

All building materials, including the wood studs within your walls and the gypsum wallboard, can also store a certain amount of moisture and still do their job properly. So as the weather changes, the building materials may be able to hold a small amount of moisture until drier air carries it away. But if the drying times are not long enough, or often enough, the extra moisture will cause problems if moisture accumulation is allowed. On the other hand a different temperature profile could prevent condensation and help keep walls drier than they would otherwise have been.

The moisture performance will depend on the type and position of the insulation and where the vapour diffusion retarder is located. Adding insulation can either cause or cure a moisture problem. When a wall is insulated the temperature inside the wall is changed. That can mean that a surface inside the wall, such as the sheathing underneath the siding, will be much colder in the winter than it was before insulation was added. Such a cold surface could become a place where water vapour moving through the wall condenses and leads to trouble, hence the need to control vapour diffusion flows.

A contributing factor to many moisture problems seen today is the higher levels of insulation used in buildings today. As we increase insulation to create more comfortable and energy efficient buildings, the materials on the exterior are cooler and do not receive heat from the interior which helps dry out the materials. By placing at least a portion of insulation on the exterior of the structure, the structure itself is protected, and the vapour diffusion retarder and the air barrier can be placed on the structural sheathing.

Insulation on the exterior of the structure keeps this plane warmer so it should not reach critical conditions where condensation could take place because it remains above the dew point, and the vapour profile would permit vapour diffusion into the interior or exterior, depending on moisture source and conditions. But it is important to keep the vapour diffusion barrier within the wall assembly, on the backside of the exterior insulation and not on the interior of the wall, especially if plywood or OSB sheathing is used. The National Building Code requires that vapour barriers be installed *sufficiently close to the warm side of the insulation to prevent condensation at design conditions (9.25.4.3)*. It further provides a table (Appendix table A.9.25.1.2.A) that sets out allowable inboard to outboard insulation ratio for low-permeance exterior sheathing, which is climate dependent.

By placing insulation on the exterior of the structure, thermal bridging through the structure is reduced if not eliminated. This also provides a much more thermally effective building envelope. As we try to improve building performance, with codes moving to effective insulation requirements, and energy efficiency initiatives like ENERGY STAR for New Homes and the R-2000 Standard being upgraded, this is going to become a more common detail in standard construction. It may be difficult to achieve their new energy targets without reducing the thermal bridging in conventional frame construction.

Some builders are already using exterior insulation, but there is still a lot of industry resistance and misunderstanding about the value of exterior insulation and concerns about moisture problems. Although any construction assembly can create problems, there will generally be fewer problems with exterior insulation, and better overall thermal performance. ☼

Degree-Days (°C)		Minimum insulation ratio
< 4,999	Vancouver, Kelowna, Ottawa, Toronto, Montreal, Fredericton, Halifax, St. John's NL	0.20
5,000 - 5,999	Prince George, Calgary, Edmonton, Regina, Winnipeg, North Bay, Quebec City	0.30
6,000 – 6,999	Ft. McMurray, Whitehorse	0.35
8,000 – 8,5000	Yellowknife	0.5
10,000 – 10,999	Iqaluit	0.6

Allowable outboard to inboard insulation rato for low permeance materials

You asked Us About: Testing for Indoor Mould

My mother-in-law and her daughter live together in a condominium apartment and have been experiencing breathing difficulties in their apartment lately. They think they have mould in their suite and it has been so bad, that recently they have stayed in a guest suite elsewhere in the building.

They don't believe that the walls have mould in them, but that the mould source is outside. My sister-in-law is hyper-sensitive to many contaminants, including dog and cat hair. They have a couple of recirculation fans with hepa filters.

Can you suggest any way of checking for airborne contaminants or moulds and what might be acceptable levels for human occupancies?

It sounds like your sister-in-law is one of a small but growing number of people that have environmental sensitivities. For people who are environmentally hypersensitive, even low levels of contaminants in the air can cause problems ranging from discomfort to debilitating illness.

This is one reason why CMHC has had the Healthy House initiative, and a few years ago published *Building Materials for the Environmentally Hypersensitive*. This book, updated in 2005, provides information on pollutant emissions and other considerations for more than 180 building materials and finishes commonly used in residential construction.

Industrial hygiene consultants generally would be the people to talk about moulds and other indoor air contaminants. CMHC also has some publications that deal with mould remediation. However, I would caution that testing for moulds will merely tell you that they are present, possibly in high concentrations, and identify some of the species that may be present, but it will not do anything to help identify the source.

If moulds are a problem, it is most important to try and identify the source of moisture that causes mould blooms and growth. I would suggest possible causes of water could be a pipe leak, or a building envelope failure that is allowing moisture accumulation.

Along with identifying the moisture sources, I would also look at the ventilation strategy - whether or not the ventilation system in the apartment is working. Ventilation is not a solution for excess moisture or mould growth, but it can help in the control of humidity levels in the unit and provides air change, removing contaminants.

The bathroom exhaust fan (assuming it has a draw) should be able to help, but it must be kept running continuously.

One other thing to consider - since this is an apartment - is whether there is a possibility that noxious fumes are entering from another part of the building. In multiple dwelling units the party walls must be airtight, but rarely are. Malfunctioning mechanical equipment, storage garage fumes not being properly exhausted, or fumes from another apartment are emission sources that can permeate into adjoining suites. ☼

The importance of proper detailing

These pictures capture the importance of good detailing on the exterior building envelope. The details were observed on a rainy day in Vancouver. Although not every location may get the rainfall that Vancouver does – some locations get even more, others may have less. Regardless of the location, when it rains, the water needs to be diverted away, so it won't penetrate the cladding where it could lead to moisture induced problems. Flashings are a key detail in shedding water, but they are also one feature many designers loathe as they may not fit the crisp aesthetic image they'd like.

Fig 1. The importance of a drip edge on the window head flashing can be seen.

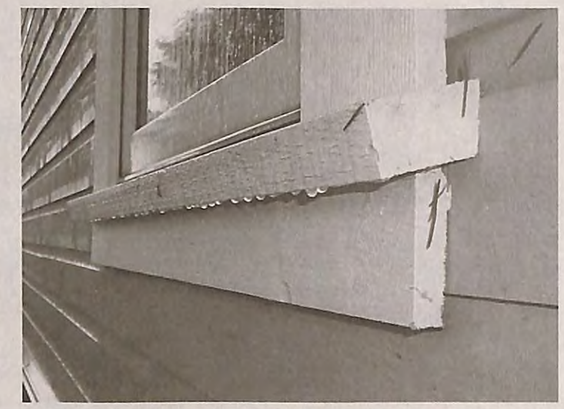

Fig 2 Windowsills are important for good performance, as the water running down the window needs to be deflected. This wood windowsill is part of the trim for a vinyl window. Not visible in the picture, there is a saw-cut drip edge on the underside of the sill, so that the water has a chance to drain off, rather than be drawn upward on the underside.

City of Vancouver Home Energy Loan Program

Homeowners in the City of Vancouver can now access low, fixed interest loans in addition to other government grants to improve the energy efficiency of their houses.

The pilot program offers loans of up to $16,000 at 4.5% interest rate over a 10-year amortization period. It was created in co-operation with Vancity Credit Union and the support of FortisBC, BC Hydro and Natural Resources Canada. Financing is available to owners of single-family homes and duplexes in Vancouver to pay for high-efficiency furnaces, boilers and hot water tanks, air-source heat pumps, insulation and weatherization.

The first step for the homeowner is to book an ecoENERGY audit. The auditor will help the homeowner select upgrades and complete the paperwork for the loan. Once the loan has been approved, the work must be completed and a follow-up audit done within 90 days. On completion, a letter of completion is sent to Vancity, and Vancity pays the contractor directly on behalf of the homeowner. The loan repayment is done on quarterly basis through the City of Vancouver's quarterly utility billing.

For more information:
www.vancouver.ca/energyloan.

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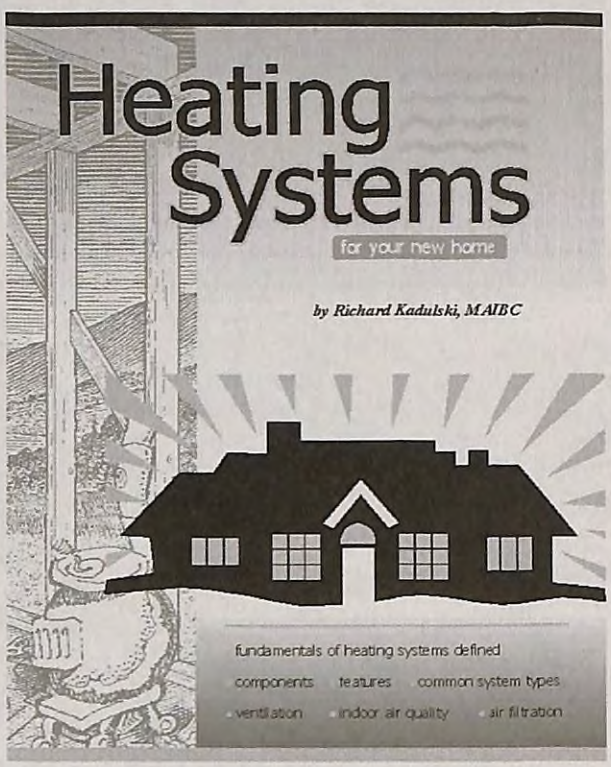
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